Univ. of Chicago

PROGRESS REPORT
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The principal feature of this report period (December 27, 1965 - June 27, 1966) has been the successful completion of the instrumentation for the program and the initiation of routing observations of low surface brightness celestial sources.

The spectrophotometer is composed of a 10-inch, F4 Newtonian telescope feeding light to a prime focus-Newtonian focus spectrophotometer employing a 6-1/2 x 8-1/2 inch replica grating ruled from the same master as the Kitt Peak National Observatory 82-inch telescope coudé spectrograph. The wavelength control is achieved by the rotation of the grating by means of a stepping motor. The signal is taken off by either a S1 or S20 photomultiplier constructed for this program by I.T.T. Industrial Laboratories. The instrument is designed to be used either as a scanner, where the spectrum is scanned almost continuously with steps of 0.1A resolution, or as a monochromator, where particular preselected wavelength regions are examined with great accuracy. In the preferred monochromator mode, the instrument can be used either as a observer controlled device or as a semi-automatic device where one can program in up to ten spectral regions to be studied and the necessary observation time for each channel. Upon command the instrument then procedes to the first wavelength, counts photoelectron pulses for the preset time and then prints out the total count on an IBM typewriter before proceding to the next wavelength. This procedure is followed through for the entire ten channel program, then is reversed, leaving the observer free to accurately guide on the object or to modify the observing procedure as required by the incoming information. This automatic capability of high reliability makes the instrument far more useful than originally envisaged.

The actual spectrometer is mounted on the extremely sturdy equatorial mounting originally used for the Bruce photographic telescope, which was rebuilt in the observatory shops. Photographs of the completed system are enclosed herewith, along with a block diagram demonstrating the function of the control and measurement components.

This research program was given a considerable stimulus by the decision of the University of Chicago to construct a new observatory facility at the Yerkes Observatory to facilitate the use and development of such instrumental research projects. The new laboratory building, designed primarily by the principal investigator, contains two 16-foot domes separated by a large electronics laboratory. The north dome, containing the spectrometer is higher than the old Bruce Building which it replaces and gives a much better view of the horizon - so important in the study of comets. The domes are equipped with overhead cranes and trap doors for rapid handling of bulky instruments, heaters for use while working on instruments during particularly cold weather, and electrical wiring suitable for a photoelectric installation. Completed views of the building are also enclosed with this report. The value of this modern facility for use in this program will greatly enhance the probability of its success.

Another important step taken during this period was the hiring of Dr. Pavel Mayer on January 1 as Research Associate for participation in this project. Dr. Mayer is a skilled and experienced observational astronomer who has developed considerable instrumentation at the Charles University in Prague, where there is a center of interest in celestial scattered light phenomena.

Observations with the completed system began on a routing basis in May, 1966, the telescope being scheduled for operation on every night except those prohibited by full moon. Owing to the absence of bright comets, the initial program has been that of spectrophotometry of the emission lines in several low surface brightness planetary nebulae and HII regions. The lines of particular interest are the first four members of the Balmer series and the λ10830 and λ5876 lines of HeI, all of which can be sensitive indicators of nebular conditions and the line strengths are in poor agreement with theoretical values. This program is proceeding satisfactorily, and it is felt that the experience gained in it will be invaluable in the final study of comets.